Dairy/Food

Koch Spiral Modules

TFC® RO/NF Series

PRODUCT DESCRIPTION:

Membrane chemistry: Proprietary polyamide Thin-Film-Composite (TFC®)

Membrane type: HR – Reverse Osmosis; SR1 – Nanofiltration

Construction: Spiral-wound with trimmable net outerwrap. Specifically designed to conform to 3A, USDA and FDA guidelines.

Options: Feed channel spacers: N1 (31 mil/0.8 mm) standard, N2 (46 mil/1.2 mm) on selected modules.

SPECIFICATIONS:

Model	Membrane Type	Nominal Permeate Flow gpd	Nominal Permeate Flow m³/d	Nominal Average Chloride Rejection %	Nominal Active Membrane Area ft²	Nominal Active Membrane Area m²
TFC-3838HR-N1	High Rejection	1,300	7.2	99.0	70	6.5
TFC-2838HR-N1	High Rejection	1,900	7.2	99.0	70	6.5
TFC-4838HR-N1	High Rejection	8,000	22.7	99.0	215	20.0
TFC-3838SR1-N1	Selective Rejection	1,500	6.8	50-56	70	6.5
TFC-2838SR1-N1	Selective Rejection	1,800	6.8	50-56	70	6.5

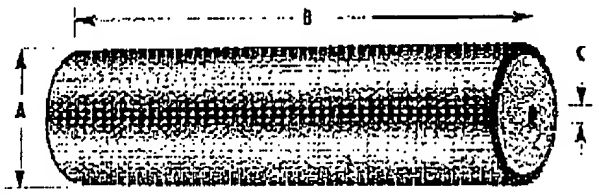
Test conditions: HR - 2000 ppm NaCl solution at 225 psi/15.5 bar, 10% recovery, 77°F/25°C and pH 7.5
SR1 - 500 ppm/1000 ppm NaCl at 225 psi/15.5 bar, 10% recovery, 77°F/25°C and pH 7.5

OPERATING AND DESIGN INFORMATION:

Typical operating pressures for the HR module – 400–600 psi/28–41 bar
Typical operating pressures for the SR1 module – 200–500 psi/14–35 bar
Operating temperature range – 40–120°F/5–50°C
Cleaning temperature range – 95–120°F/35–50°C
pH range for continuous operation – 4.0–10.0
pH range for Clean-In-Place (CIP) – 2.0–11.0
Design pressure drop per element – 10 psi/0.7 bar
Design pressure drop per vessel (5-in-series) – 50 psi/3.5 bar

PRODUCT DIMENSIONS:

Model	A (diameter) inches	A (diameter) mm	B (length) inches	B (length) mm	C (I.d.) inches	C (I.d.) mm
TFC-3838HR-N1	3.8	96	38.0	965	0.851	21.1
TFC-2838HR-N1	3.8	96	38.0	965	0.851	21.1
TFC-4838HR-N1	8.0	203	38.0	965	1.136	28.9
TFC-3838SR1-N1	3.8	96	38.0	965	0.851	21.1
TFC-2838SR1-N1	3.8	96	38.0	965	0.851	21.1



KOCH MEMBRANE SYSTEMS
Fluid Systems

BEST AVAILABLE COPY

TFC® Food & Dairy RO/NF Modules

Membrane characteristics

- TFC®-HR *High Rejection* modules provide higher flux and high rejections (typically >99.95% protein and lactose rejection).
- TFC®-SR *Selective Rejection* modules are selected when desalting and organic concentration is the objective. TFC®-SR will preferentially pass monovalent salts such as sodium chloride yet retain divalent salts, proteins and sugars (such as lactose) with rejections typically >99%.

Operating limits

- Operating pressure: Maximum operating pressure for HR is 1000 psi/69 bar; maximum operating pressure for SR1 is 600 psi/41 bar.
- Permeate pressure: Permeate pressure should not exceed baseline (concentrate) pressure at any time (including on-line, off-line and during transition). Reverse pressure will damage the module.
- Differential pressure: The maximum differential pressure per module is 12 psi/0.8 bar. The maximum differential pressure for any length vessel is 60 psi/4.0 bar.
- Temperature: Maximum operating and cleaning temperature is 120°F/50°C.
- pH: Maximum cleaning pH is 11.2. Minimum cleaning pH is 1.8.

Water Quality for Cleaning and Diafiltration

- Turbidity and SDI: Maximum feed turbidity is 1 NTU. Maximum feed SDI is 5.0 (15-minute test).
- Water Quality Guidelines: Please refer to Koch's *Water Quality Guidelines for CIP and Diafiltration* for more detailed information.

Cationic (positively charged) polymers and surfactants and lubricants

- Cationic polymers and surfactants: TFC® membranes may be irreversibly fouled if exposed to cationic (positively charged) polymers or surfactants. Exposure to these chemicals will void the warranty.
- Lubricants: For module installation, use only water or glycerin to lubricate seals. The use of petroleum or vegetable-based oils or solvents may damage the module and void the warranty.

Chlorine Exposure

- TFC®-HR has a free chlorine tolerance rating of 1000 ppm-hours at 77°F/25°C, pH 8.
- TFC®-SR1 membrane has a free chlorine tolerance rating of 2,000 ppm-hours at 77°F/25°C, pH 8.
- The maximum continuous chlorine exposure limit is 0.1 ppm.
- Sodium metabisulfite (without catalysts such as cobalt) is the preferred chemical to eliminate free chlorine or similar oxidizers in the feed.
- Chlorine tolerance for TFC® membranes may be significantly reduced if catalyzing metals such as iron are present or if the feed pH and/or temperature conditions are different than stated.
- Refer to *RO/NF Cleaning Procedures* for sanitization instructions.

Supplemental Technical Bulletins

- RO/NF Module Cleaning Procedures
- UF Module Cleaning Procedures
- Water Quality Guidelines for CIP and Diafiltration

Koch's Capability

Koch Membrane Systems is the leader in crossflow membrane technology, manufacturing microfiltration, ultrafiltration, nanofiltration, and reverse osmosis membranes and membrane systems. The industries we serve include food, dairy and beverage, electronics, transportation, chemical, municipal and general manufacturing. Koch adds value by providing quality membrane products and by sharing our experience in the design and supply of thousands of membrane filtration systems worldwide.

Service and Ongoing Technical Support

Koch has an experienced staff of professionals available to assist endusers and OEM's for optimization of existing systems and support with the development of new applications. We have an ongoing R&D program evaluating unique membranes and components to ensure the availability of state-of-the-art products. Whenever you need our help, it's just a phone call away at 800-343-0499 (U.S.) or 978-657-4250. Koch's Process Technology and Technical Service Departments will provide you with knowledgeable technical assistance whether its staff training, a thorough review of system operation, or recommendations for fine tuning your system.

Koch Membrane Systems, Inc.
US Headquarters
850 Main Street, Wilmington, MA 01887-3388
TEL 978-657-4250 800-343-0499 (In USA)
FAX 978-657-5208

Visit our website
www.kochmembrane.com

China England France Germany Italy The Netherlands Spain

KOCH MEMBRANE SYSTEMS Fluid Systems

4/99 - 2.5M KFN 0678305

KOCH MEMBRANE SYSTEMS

Membranes for Food Use

Membrane Type	Molecular Weight Cut-Off (1,000 / 10,000 / 100,000 / 1,000,000)	Configuration
TFC-BQ		Spiral
TFC-S		Spiral
TFC-SR 1		Spiral
TFC-SR 2		Spiral
MPW-34		Spiral/Tubular
MPW-36		Spiral/Tubular
HFK-328		Spiral
HFK-131		Spiral
HFM-116/100		Spiral/Tubular
HFM-180		Spiral/Tubular
MFK-618		Spiral
MFK-601		Spiral
MFK-617		Tubular
PM-10		Hollow Fiber
PM-50		Hollow Fiber
PM-100		Hollow Fiber
PM-500		Hollow Fiber

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Date: 7/8/2002

Contact: Mary Beth Jarvis
316-828-3756
jarvismj@kochind.com

Koch Membrane Systems Introduces the SR2 Nanofiltration Membrane
Selective Rejection Membrane Expands Fluid Systems Product Range

WILMINGTON, Mass. -- Koch Membrane Systems, Inc. (KMS), the world leader in membrane separation technology, has extended its range of selective rejection nanofiltration (NF) membranes for water and wastewater treatment, with the launch of its new Fluid Systems™ TFC®-SR2™ element.

"The Fluid Systems ™ SR2™ features groundbreaking characteristics of very low pressure, high specific flux membranes ideal for efficiently removing divalent ions such as hardness and sulphate, and dissolved organics from municipal drinking water or industrial wastewater streams," said Alan Franks, senior development engineer for KMS. "Hardness rejection is typically 97 percent and organic rejection over 90 percent for organics with molecular weight in the range of 300 daltons."

Operating at extremely low pressures, typically 50 psi (3 Bar), the membrane is very energy efficient and capable of producing more water per square meter (m2) of membrane surface area than competitive products, Franks said. It is ideal for municipal and industrial, for example, treating large volumes of drinking water in municipal plants to remove dissolved organics and hardness.

The Fluid Systems™TFC®-SR2™membranes are available in 4-inch and 8-inch diameters and in standard 40-inch or Magnum® 60-inch lengths.

Franks said the latest innovation, one of several new and improved RO/NF membrane products, maintains KMS' reputation as the world leader in membrane separation technology.

More information is available at www.kochmembrane.com. Customers can reach company representatives at either of the following offices:

Corporate Headquarters, 850 Main St., Wilmington, Mass. 01887, Phone (800) 343-0499 or Fax (978)657-5208. OR Fluid Systems RO/NF Sales Office, 10054 Old Grove Road, San Diego, Calif., 92131, Phone (800) 525-4369; Fax (619) 695-2176.

"TFC", "SR2" and "Fluid Systems" are Trademarks of Koch Membrane Systems, Inc. Koch Membrane Systems, a world leader in membrane separation products, acquired Fluid Systems Corporation in 1998. Today the Fluid Systems™ brand remains at the forefront of leading-edge membrane technology. The company, headquartered in Wilmington, is a subsidiary of Koch Chemical Technology Group, LLC.

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Dairy/Food

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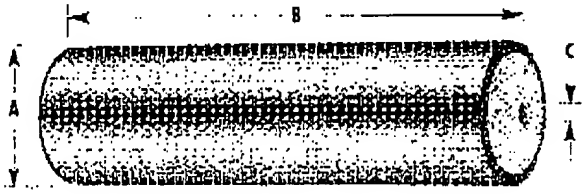

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Fluid Systems

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KOCH MEMBRANE SYSTEMS
Fluid Systems

4/99 - 2.5M EPN 0678305

KOCH MEMBRANE SYSTEMS

Membranes for Food Use

Membrane Type	Molecular Weight Cut-Off (1,000 · 10,000 · 100,000 · 1,000,000)	Configuration
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TFC-S		Spiral
TFC-SR 1		Spiral
TFC-SR 2		Spiral
MPW-34		Spiral/Tubular
MPW-36		Spiral/Tubular
HFK-328		Spiral
HFK-131		Spiral
HFM-116/100		Spiral/Tubular
HFM-180		Spiral/Tubular
MFK-618		Spiral
MFK-601		Spiral
MFK-617		Tubular
PM-10		Hollow Fiber
PM-50		Hollow Fiber
PM-100		Hollow Fiber
PM-500		Hollow Fiber

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EXHIBIT C

Date: 7/8/2002

Contact: Mary Beth Jarvis
316-828-3756
jarvism@kochind.com

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